

We claim:

1. A composite comprising a metallic substrate, a substantially amorphous and substantially non-porous aluminophosphate film and a component therebetween, said component comprising a phosphate group in bonded interaction with an oxide of a metal component of said substrate.
2. The composite of Claim 1 wherein said aluminophosphate film comprises and aluminum content selected from less than stoichiometric, greater than stoichiometric and stoichiometric, said content relative on a molar basis to phosphorous.
3. In the composite of Claim 1 further comprising nanoparticles selected from carbon and a metal compound.
4. The composite of Claim 1 wherein said substrate is a steel alloy and said oxide is selected from an iron oxide and a chromium oxide.
5. The composition of Claim 1 wherein said film has a thickness dimension of about 0.05 micron to about 10 microns.
6. The composition of Claim 5 wherein said film has a thickness dimension from about 0.1 micron to about 1.0 microns.
7. The composition of Claim 5 further including an organic component on said film.
8. The composition of Claim 5 wherein said film is opaque.
9. A high-temperature stable composition comprising an aluminophosphate compound, said compound substantially amorphous, and carbon nanoparticles therein.
10. The composition of Claim 9 further including nanoparticles of a metal compound.
11. The composition of Claim 9 wherein said aluminophosphate compound comprises an aluminum content selected from less than stoichiometric, greater than stoichiometric and stoichiometric, said content relative on a molar basis to phosphorous.
12. The composition of Claim 11 wherein said aluminophosphate compound has an aluminum content greater than stoichiometric.
13. The composition of Claim 9 comprising a coating on a substrate.

14. A high-temperature stable, substantially amorphous aluminophosphate compound, said compound having an aluminum content relative to said phosphorous, said compound substantially absent chloride ion.

15. The compound of Claim 14 further including carbon nanoparticles.

16. The compound of Claim 14 further including nanoparticles of a metal compound.

17. The compound of Claim 14 wherein said aluminum content is selected from less than stoichiometric, greater than stoichiometric and stoichiometric, said content relative to phosphorous.

18. A method of using an aluminophosphate compound to lower the surface energy of a substrate, said method comprising:

providing a precursor to an aluminophosphate compound, said precursor comprising an aluminum salt and phosphorous pentoxide in a fluid medium;

applying said medium to a substrate; and

heating said applied medium for a time and at a temperature sufficient to provide a non-wetting, substantially amorphous and substantially non-porous aluminophosphate compound on said substrate.

19. The method of Claim 18 wherein said fluid medium is an alcoholic solution of said aluminum salt and phosphorous pentoxide.

20. The method of Claim 19 wherein said application is selected from dip-coating and spraying.

21. The method of Claim 18 wherein said aluminophosphate compound on said substrate is non-wetting for molten aluminum.

22. A composite comprising a metallic substrate and a substantially amorphous, substantially non-porous aluminophosphate film on said substrate, said composite having a surface energy of about 32 mJ/m².